

FOR  
**EFFICIENT REGULATION  
OF AN AIR-CONDITIONING  
SYSTEM**



**THREE-LEAD, NULL-TYPE  
ELECTRICAL-RESISTANCE  
THERMOMETERS**

BULLETIN 4001  
1935

CABLE ADDRESS: "LEEDSNORTH"  
BENTLEY CODE

**LEEDS & NORTHRUP COMPANY**  
4900 STENTON AVENUE  
PHILADELPHIA, PA.



Regardless of distance to detectors located throughout the building, L & N Three-Lead, Null-Type Apparatus Terminals bring together reliably, at one convenient point, all facts needed to guide air-conditioning operation.



## TO REGULATE AN AIR-CONDITIONING SYSTEM FOR CONSTANCY OF ATMOSPHERE

### FACTS MUST BE BROUGHT TOGETHER AT ONE CONTROL POINT

The return which the owner gets from an air-conditioning system is measured by the constancy with which temperature and humidity are held at correct values. The investment is not primarily in conditioning machinery, but in comfort.\* To assure the desired return on such an investment, the air-conditioned building must be equipped not only with proper conditioning units but also with adequate means for supervising them.

In a sense, air conditioning is a manufacturing process. Outside and return air are raw materials which must be tested as they feed in. Dehumidifiers, coolers, condensers, etc., are machines which require continuous regulation. Conditioned atmosphere is the product and needs inspection.

Due to the time needed to circulate the large volume of air required, response to control is inherently slow. Even moderate departures from normal take time to correct. Only by detecting departures and restoring them to normal while they are small can uniformity be maintained.

To get from a modern system the uniform results of which it is capable, the operator must have the needed facts where he can see them all at once. If the individual units are controlled automatically, he knows when this control is adequate, and when it must be supplemented. Whether he has automatic controls or regulates entirely by hand, he knows when to make adjustments that will stop departure trends while they are small. In this way he supervises his system for constancy of atmosphere.

### FACTS ARE GATHERED CONVENIENTLY AND RELIABLY BY THREE-LEAD, NULL-TYPE RESISTANCE THERMOMETERS

The facts needed are facts about temperatures, including wet-and-dry-bulb temperatures for relative humidity. This calls for a thermometer system. And it is important that the system selected be both adequate and reliable.

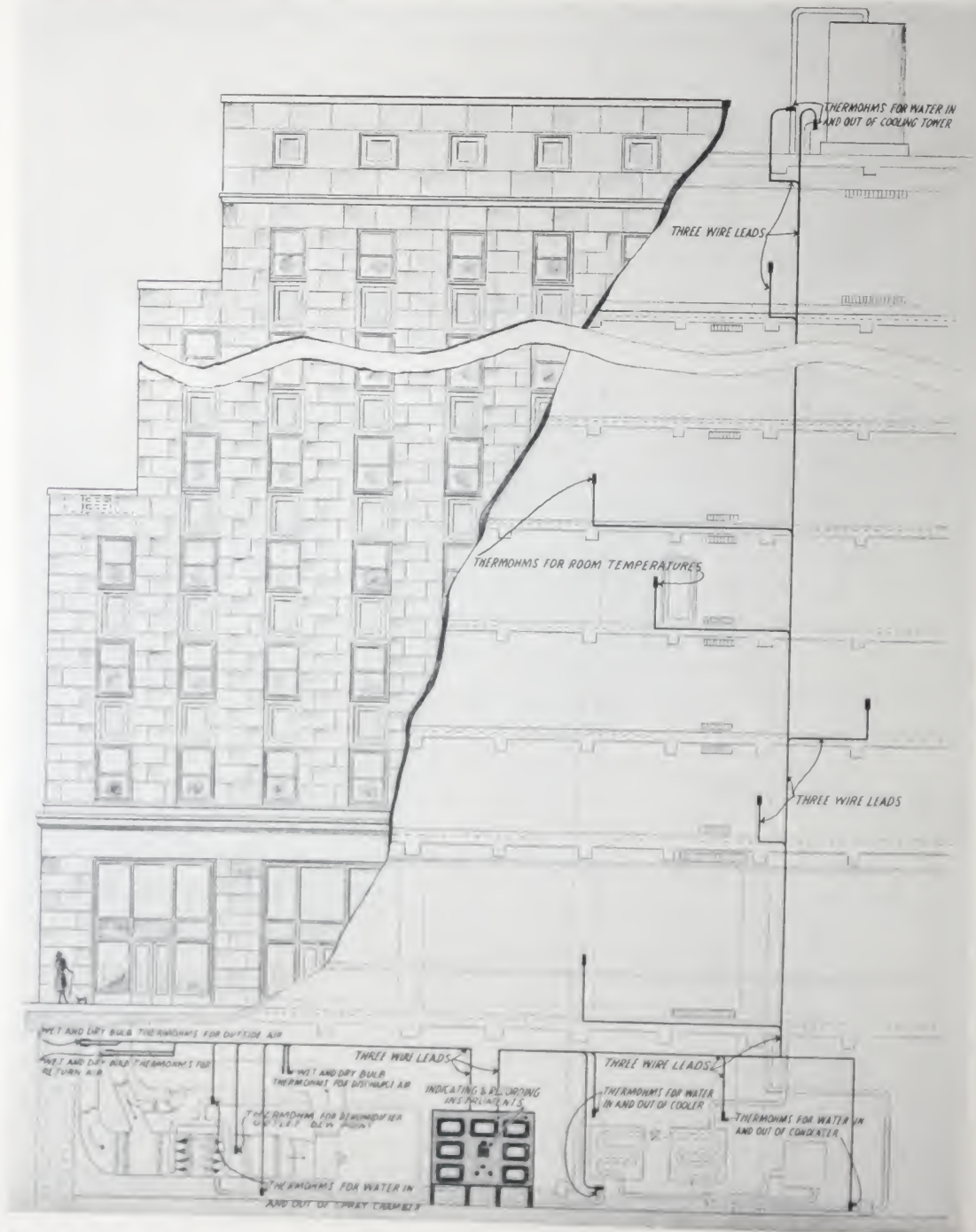
Because the three-lead resistance thermometer system with null-type instruments described in the following pages is independent of variations in lead resistance, it operates reliably regardless of the distances over which measurements are made. It permits temperatures to be taken anywhere in the building and instruments to be located at any convenient place. It allows any desired length of connecting leads to be permanently installed at reasonable cost. Detectors at one end can be replaced and instruments at the other can be rearranged, if ever desired, without recalibration of leads, instruments or detectors. Extensions are easily made.

Instruments that indicate clearly or record on wide charts can be chosen to give just the infor-

mation the operator wants when he wants it. Without leaving his control station he can have the facts he would get if he could tour the building and read a reliable thermometer at each detector location. The instruments will bring him occasional readings; will report at regular intervals; or will keep him informed as continuously as though he could watch simultaneously at many locations.

Since operation of conditioning units can be no more correct than the readings on which the operator acts, his thermometers should be thoroughly reliable. To have them so adds only a little to the first cost, and the entire first cost is a small part of the total conditioning investment. Such thermometers are often cheaper to install and will almost certainly be cheaper to maintain. They give the operator adequate information on which to operate economically; to maintain comfort\* constantly; to realize the largest possible return on the entire conditioning investment.

\*L & N equipment described in this bulletin is applicable to commercial or industrial air-conditioning systems, whether for human comfort or for control of a process.



Typical locations for Thermohms and instruments are here suggested. Diagram merely shows enough of building, ducts and conditioning equipment to illustrate the application of a three-lead, null-type resistance thermometer system



## THE CORRECT THERMOMETER PRINCIPLE CORRECTLY APPLIED

NULL-TYPE  
MEASURING  
INSTRUMENT

THREE WIRE LEADS

An L & N Resistance Thermometer consists of three simple elements: a null-type measuring instrument; three-wire leads; and a detecting Thermohm—which combine to form an electrical balance. A number of Thermohms are usually connected, one after another, to each instrument

THERMOHM

No other method for measuring temperatures meets so exactly the needs of air conditioning as does the electrical resistance thermometer method using null-type\* instruments and three-wire leads. For measurements in air conditioning, three-lead, null-type resistance thermometers (not mere resistance thermometers) are inherently correct in principle and, as engineered by Leeds & Northrup, are convenient and thoroughly reliable.

### L & N ELECTRICAL RESISTANCE THERMOMETERS

These three-lead, null-type thermometers translate temperatures into electrical resistance values which are measured reliably, over long or short distances, with convenience and flexibility that no other type can match.

The resistance (opposition) of nickel wire to the flow of a small current increases as the temperature of the wire is raised, and the resistance at any given temperature is always the same.

A length of nickel wire, specially treated, wound and mounted, is known as a Thermohm. A Thermohm is connected through leadwires to an indicating or recording instrument which actually measures resistance but is graduated in temperature degrees. Thermohm, instrument and leads constitute a thermometer, and the kind of instrument and number of leads are vitally important.

### NULL-TYPE MEASURING INSTRUMENTS

At the Thermohm, temperature is translated reliably into electrical resistance, and to measure this resistance with equal reliability requires a null-type instrument.

Such an instrument is actually an electrical balance.\* It balances Thermohm resistance against a standard resistance in the instrument. This standard is adjusted, by hand or auto-

matically, to match the resistance of the Thermohm, just as a chemist places standard weights on one pan of his sensitive balance until they match an unknown weight on the other. This balance method is dependable.

The standard resistance and other parts of the circuit in the instrument are of a special alloy which is unaffected by temperature, so that temperature variations at the instrument do not affect the measurement. When the standard and Thermohm resistances balance, the instrument shows the temperature of the Thermohm.

### THREE-WIRE LEADS

One advantage of the method is its reliability when measuring temperatures of Thermohms at various, and often very long, distances from the instrument. Length of leads to the several Thermohms, temperature changes along the leads, and voltage variations in the supply to the circuit are without effect on accuracy. Measurements reflect only resistance changes in the Thermohm.

But to do this requires three-wire leads, by means of which the instrument circuit is in effect extended right out to the Thermohm. The circuit resistance in the instrument and through the leads as well, is so divided that exactly half is always on each side of the balance, so that there is direct comparison between standard and Thermohm.

The result is that measurements at any distance are reliable and stable. Length of leads can be changed at any time. Nearby and distant Thermohms are measured reliably with equal accuracy regardless of temperatures at the instrument or along the leads.

L & N electrical thermometers, using null-type instruments with three-wire leads, are outstandingly reliable and remain so throughout the life of the installation.

\*Wheatstone Bridge.



This type of wet-and-dry-bulb Thermohm assembly is placed in air ducts to determine load and to guide dehumidifier operation, or in rooms (as shown in the illustration above) where both tem-

perature and humidity are to be measured. The upper Thermohm can be used alone in ducts where dry-bulb temperatures only are desired

## FREEDOM IN CHOICE AND LOCATION OF UNITS

Standard L & N units can be combined to form a comprehensive thermometer system that gives complete data on the most elaborate condi-

tioning installation; or the combination may be limited to minimum instrumentation for a given job.

### SELECTION OF THERMOHMS

Points at which it is desired to take temperatures (and humidities) can be chosen at will. There are standard Thermohms for room, air-duct and water-line mounting.

To indicate outdoor conditions, and thus determine roughly the load which the system has to carry, Thermohms for both wet-and-dry-bulb readings are placed in outside air ducts.

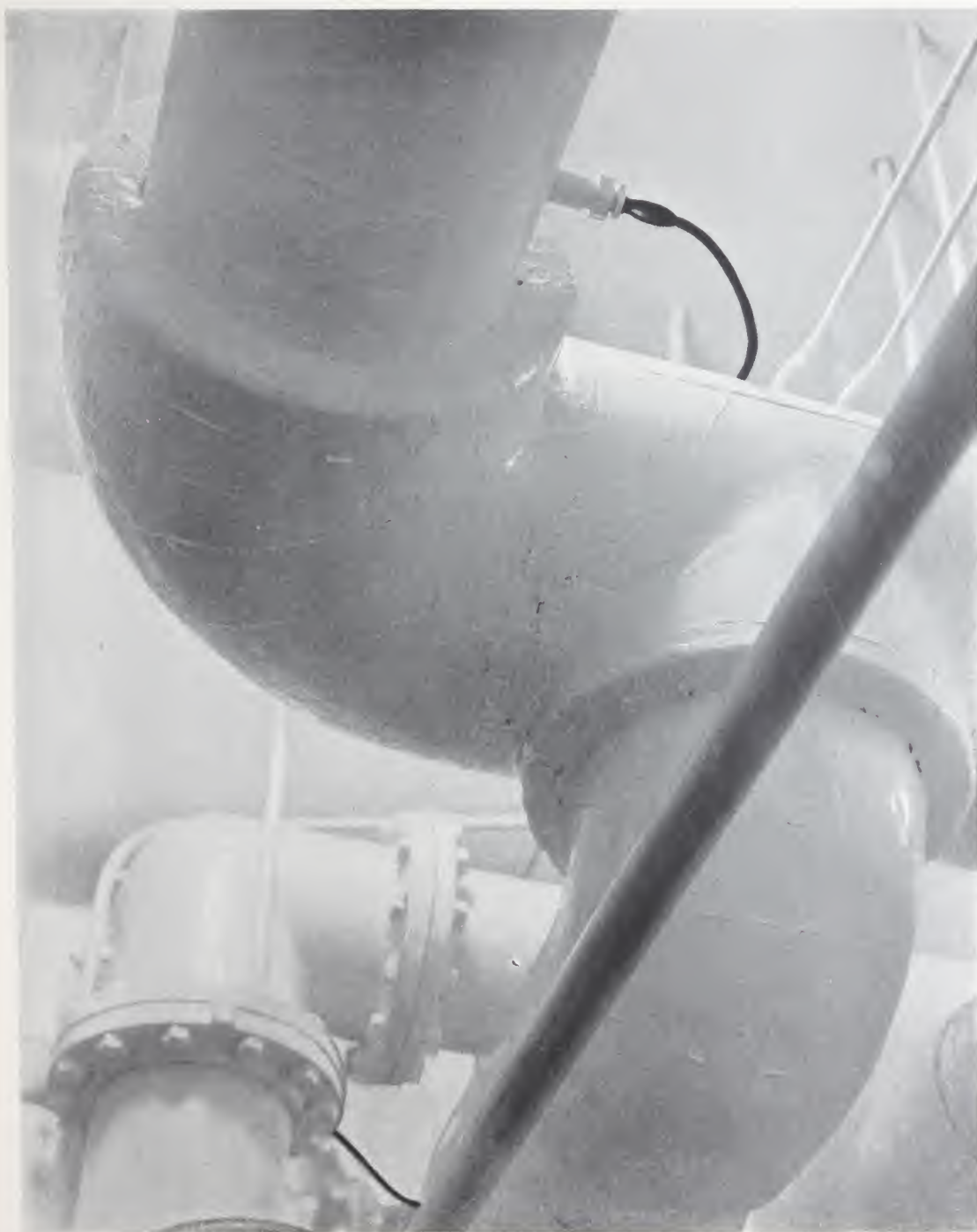
Then, to guide dehumidifier operation according to actual conditions in the building, additional wet-and-dry-bulb Thermohms are placed in

return and discharge air ducts, and a single Thermohm is placed in the spray chamber to measure dew point.

And, to guide regulation of conditioning equipment to meet demands at the dehumidifiers, Thermohms are placed in water lines to and from spray chambers, coolers, condensers and towers.

To inspect condition on various floors, at different exposures, or in specific locations, dry-bulb Thermohms (wet-bulb also if humidity is wanted) can be placed at strategic points.





To guide regulation of conditioning equipment, Thermohms are placed in water lines



To inspect temperatures at various locations, Thermohms for dry-bulb readings can be mounted as illustrated above





Where occasional readings satisfy requirements, a manually-operated indicator and switches can be installed

### CHOICE OF INSTRUMENTS

Any convenient location can be chosen for the instruments, at which location temperatures of any number of Thermohms can be indicated or recorded.

#### FOR OCCASIONAL DATA

If it is desired to give the operator the facts he would get by going to detector locations only as he must have information, choose an indicator and a switch or switches with points enough for the Thermohms.

Any number of Thermohms can be handled and readings of each conveniently presented. An indicator can be switched instantly to any of its Thermohms.

#### FOR DATA AT REGULAR INTERVALS

To give the operator the data he would get if he could visit many detector locations in quick succession, choose one or more multiple-point recorders. These Micromax instruments record a reading about once a minute automatically. The frequency with which each Thermohm is read depends on the number (up to 16) assigned to that recorder.

One multiple-point recorder may carry any combination of room, air-duct and water-line temperatures. Depending on the number of points it accommodates, it may report the temperatures for one or more conditioning units. Those relating to a given unit usually appear on the same recorder chart. Unless assigned to



Where complete records are wanted, multiple-point recorders gather data automatically

separate two-point instruments, definitely-related pairs such as wet-and-dry-bulb readings, water-in-and-out, etc., are usually arranged so that they appear successively in a multiple-point recorder cycle.

#### FOR PRACTICALLY CONTINUOUS DATA

To give the operator what he would get if he could stand almost constantly at each of a number of locations, choose two-point recorders. These concentrate on pairs of related temperatures and plot the two records side by side so that the individual temperatures and the difference between them are easily read.

#### FOR A VARIETY OF DATA

In some installations it is enough to indicate readings. In others it is better to record. In many it is best to indicate some readings and record others. For example, temperatures taken at irregular intervals to inspect rooms, corridors, etc., may be indicated, while those referred to constantly in operating the system are recorded.

Whatever the desired form, number and frequency of the readings, standard units combine to give the desired result conveniently and reliably. If, later, requirements change, or more facts are wanted, service can be rearranged or extended as easily as telephone service.





In many installations it is best to indicate some readings and record others

MODEL R MICROMAX  
TWO-POINT RECORD  
CONTINUOUS LINE

MODEL S MICROMAX  
TWO-POINT RECORD  
CONTINUOUS LINE

DEG. FAHR.

All ruling is in pale green. Two-point records are drawn in red ink. Multiple-point records are normally printed in blue ink. Up to 6 points can be supplied in separate colors for each point.

MODEL S MICROMAX  
TWO-POINT RECORD  
DOT AND DASH

MODEL S MICROMAX  
MULTIPLE-POINT  
RECORD  
6 POINTS

MODEL S MICROMAX  
MULTIPLE-POINT  
RECORD 12 POINTS  
(Here numbered from 6.1 to 7.2)

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LEEDS & NORTHROP CO.

NO. 59

MADE IN U.S.A.





The operator tours the entire building electrically, from basement to roof

## CONVENIENT

Without leaving his control station, the operator receives in the most convenient form all the information he needs. He tours the entire building electrically, from basement to roof.

With an indicator before him, it is easy to measure the temperature of any Thermohm or of many in quick succession. He turns a switch to a number, rotates a knob to balance the instrument, and the temperature is indicated clearly.

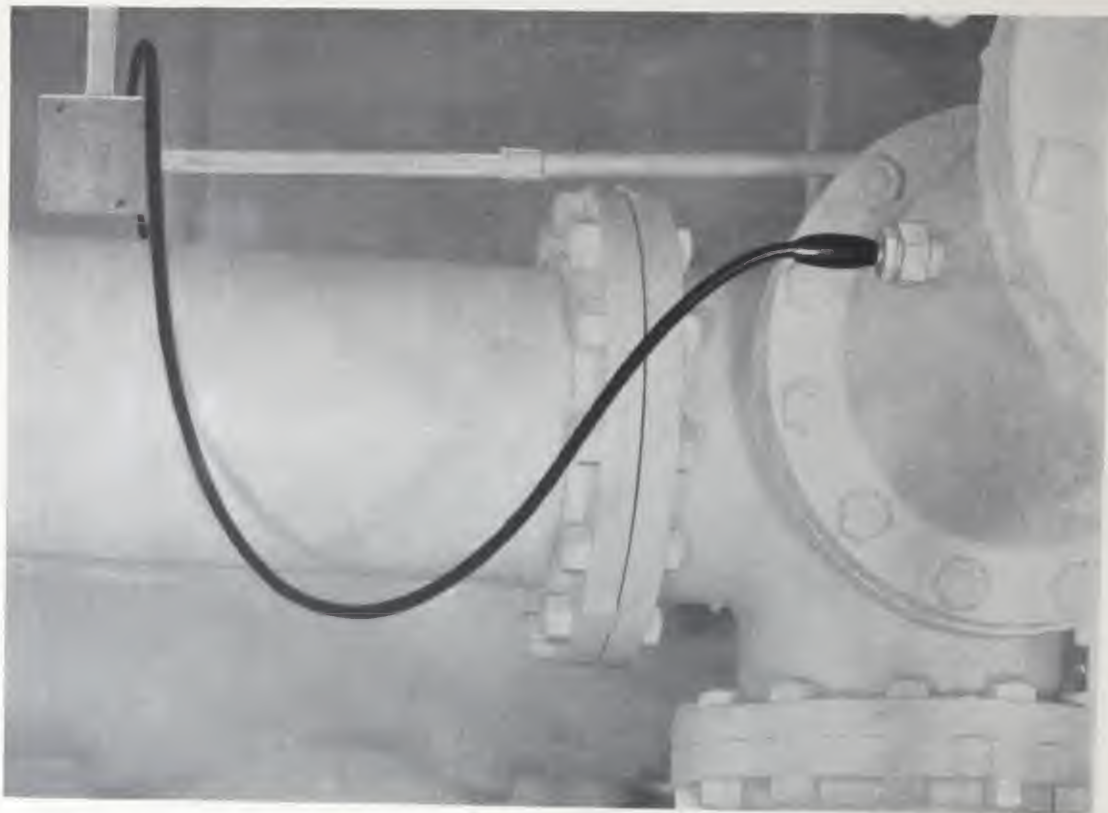
With any Micromax recorder, he has only to read a record placed automatically before him. These instruments select the Thermohm, balance the circuit and record the temperatures on permanent charts.

In a Model S Micromax multiple-point recorder, a motor-driven switch connects one Thermohm after another to the instrument. The balancing mechanism, composed of mechanically-interlocked parts, operates automatically and also moves a printing device across a chart that

is  $9\frac{7}{8}$ " wide, to print a dot for each temperature and alongside it the Thermohm number.

A Model S or Model R Micromax two-point recorder accommodates two Thermohms, usually for related temperatures such as wet-and-dry-bulb readings. The balancing mechanism is identical with that used in multiple-point recorders, but the marking device is a pen which draws a record in red ink. Model S draws, on a strip chart, either a dot and dash record (where the dot identifies one Thermohm, the dash the other), or a continuous line (where the edges of the pattern form the separate records and the band between shows wet-bulb depression, or other temperature-difference). Model R draws a continuous line record, on a 24-hour circular chart  $9\frac{1}{4}$ " in diameter with a scale  $3\frac{1}{2}$ " wide.

All of the above instruments can be installed to meet individual conditions, and can be rearranged if ever desired, without help from the instrument manufacturer.



Thermohms and leads, like the instruments to which they connect, are rugged units and require minimum maintenance

## LITTLE MAINTENANCE

This equipment has been highly standardized over a period of thirty years in applications where conditions are similar to those now presented by air conditioning. Thermohms, switches, indicators and recorders are all rugged and simple.

Thermohms, all alike in calibration, are adjusted, like the resistors in the instruments, against standards certified by the U. S. Bureau of Standards. All are interchangeable. A Thermohm can be replaced without disturbing leads or calibration of instrument. The instrument set-up can be rearranged without affecting Thermohms or leads.

Thermohms are durable and each is built for a definite service. All nickel Thermohms have the same calibration curve, and are therefore interchangeable. Cases provide ample protection to the winding, without sacrifice of sensitivity. Wicks of wet-and-dry-bulb assemblies can be

kept moistened by connection to the regular water supply, or with a bottle feeder.

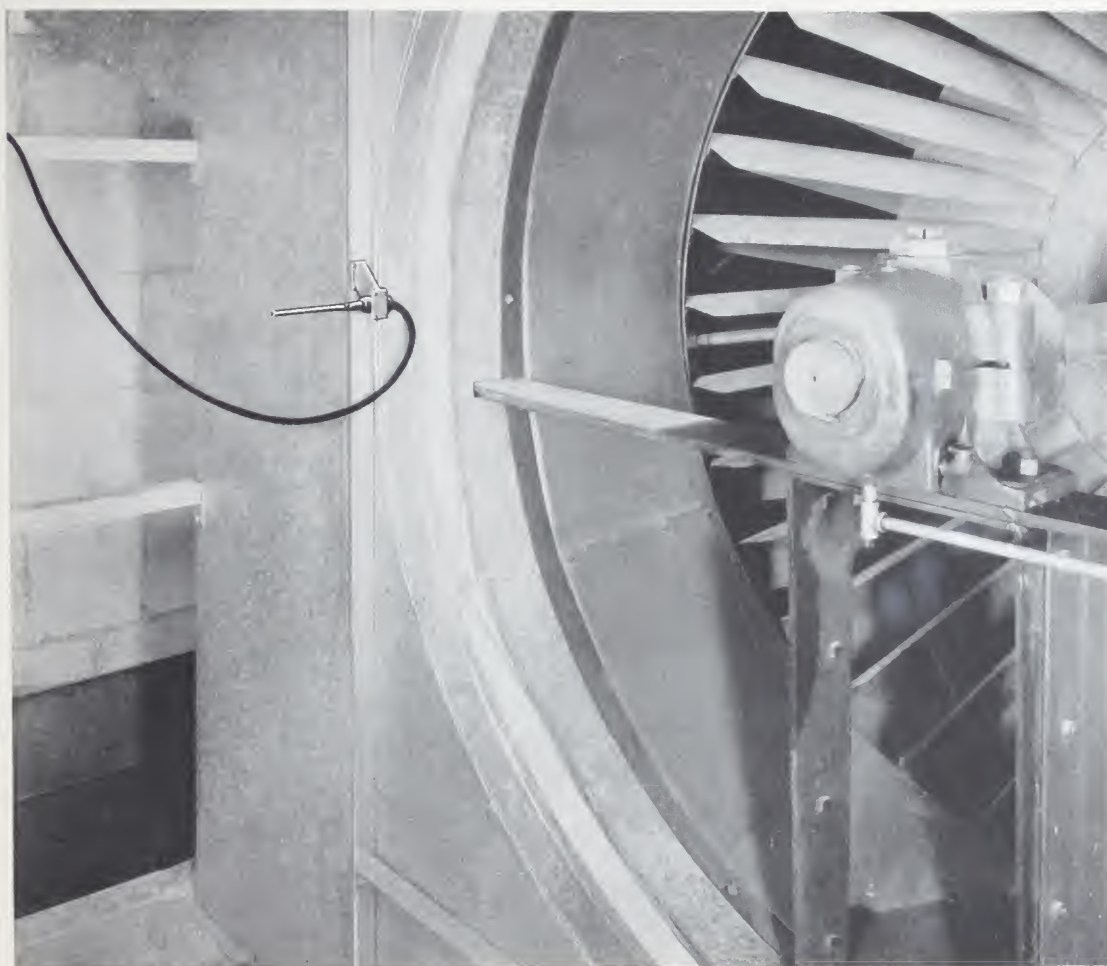
Leads do not affect the measurement. Once installed, they can be expected to remain in place permanently.

Indicators have only two moving parts and only need simple cleaning at long intervals.

Micromax recorders, either Model S or Model R, are machine-like instruments. Parts are regular machine types—standardized and replaceable. Any good mechanic can keep them operating. The case keeps dust out. Lubrication is needed infrequently. Routine maintenance averages only a few minutes a week.

At negligible annual expense and without help from the manufacturer, a three-lead, null-type resistance thermometer equipment can be put in service and kept operating reliably by plant maintenance men.





L & N Resistance Thermometer Equipments are assemblies of standard interchangeable units, easily installed

## EASY TO INSTALL

Thermohms can be placed wherever it is desired to take temperatures. Distance of any such location from the control point need not be considered. Thermohms with suitable protecting wells are available for standard mounting in water lines of any diameter. Others are designed for greatest ease of mounting on walls or in air ducts.

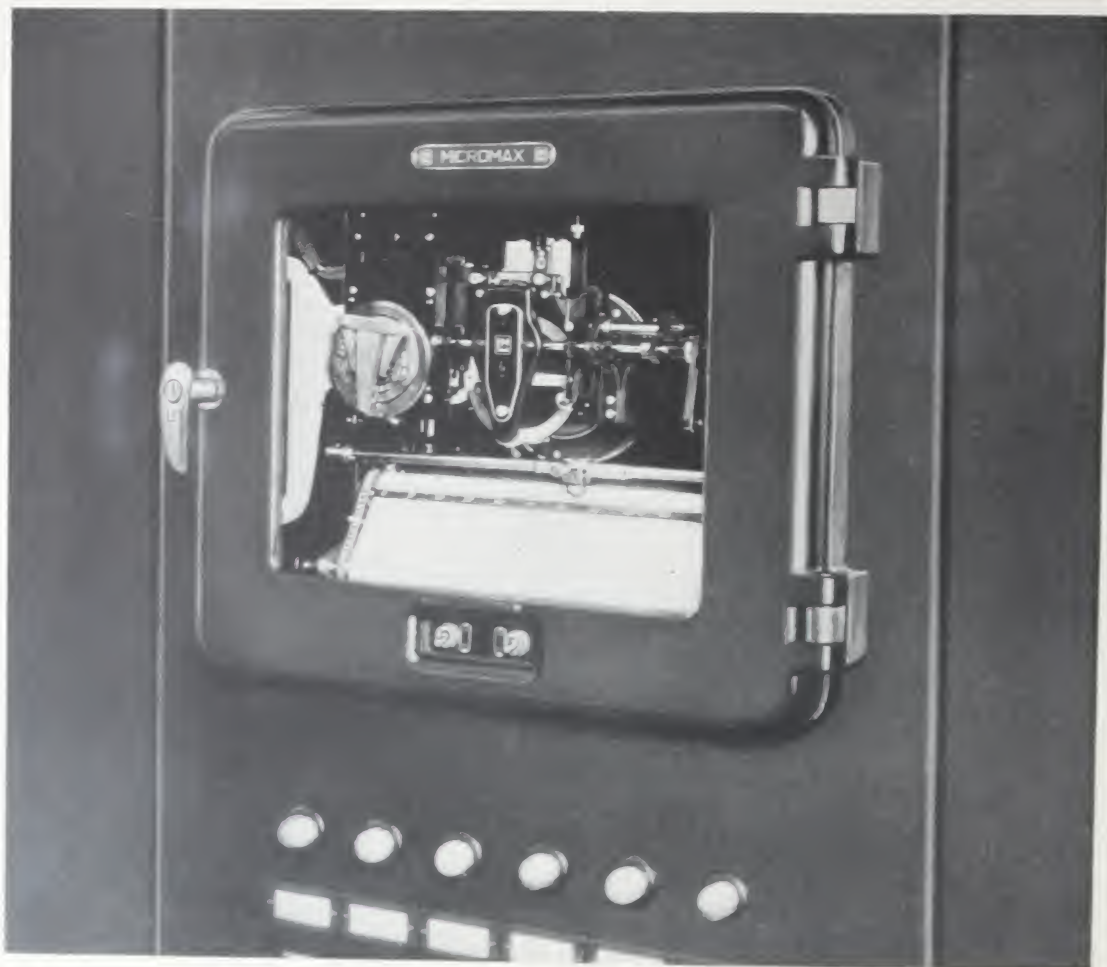
Instruments are mounted on a panel or wall at any convenient control point.

Three-lead copper conductors are run from the control point to each chosen Thermohm location. Because this leadwire need not be calibrated, it is reasonably priced and temperature conditions along its length need not be considered. The

ordinary precautions used for electric service wiring are satisfactory. Long lengths can be used freely because they do not introduce prohibitive costs, and the length has no effect on the measurement.

Leads are installed like ordinary wiring familiar to any electrician. They are soldered to Thermohms at one end and to switch points at the other, simple connections are made at the instruments, recorder motor connections are plugged into an ordinary lighting circuit and the equipment is ready to operate.

The system leaves the factory as a group of standard, interchangeable units which the user can install and operate without assistance.



By furthering control for constancy of atmosphere, L&N Electrical Resistance Thermometers foster maximum return on the entire air-conditioning investment

## SOUND INVESTMENT . . . LARGE RETURN

This system is a self-liquidating investment that helps prevent losses far in excess of its purchase price.

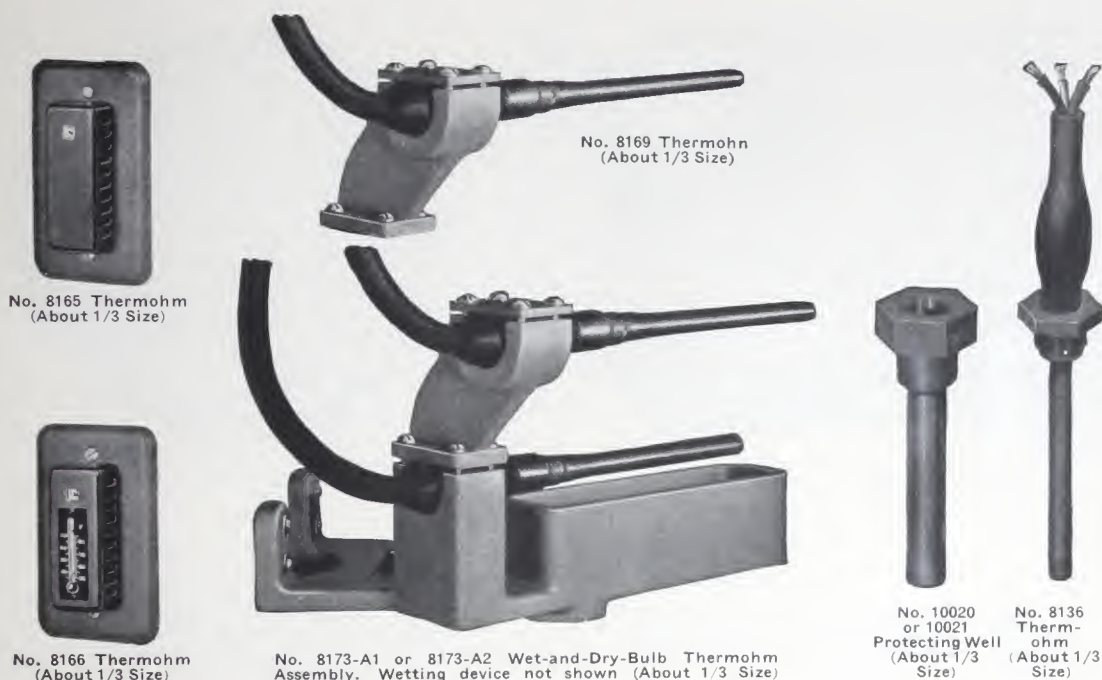
It saves the direct cost of gathering information. More important, it shows departure trends before they gain headway, and makes possible the direct savings which result from economical operation—operation which costs less because only small adjustments are needed. Most important, by furthering control for constancy of atmosphere, it fosters full realization of the true value of air conditioning—uninterrupted comfort, which attracts tenants or patrons (or in an industrial installation improves product quality).

Some users tell the public about their air conditioning by installing, in show window or lobby, a Micromax Model R recorder with its giant dial—showing the comfort that exists within. Such equipment helps management to sell office space or to attract patrons.

The first cost of L&N Resistance Thermometers for temperature and humidity measurements is a small part of the total air-conditioning investment, and these thermometers are economical to install and maintain. Tell us about the needs of your present or contemplated air-conditioning installation and let us recommend appropriate instruments.



## LEEDS &amp; NORTHRUP COMPANY

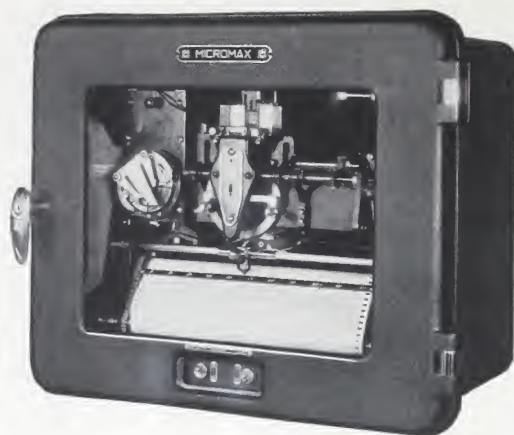


## THERMOHMS

- 8165 THERMOHM, for Wall Mounting**  
Nickel wire resistor.
- 8166 THERMOHM, for Wall Mounting**  
Same as No. 8165, but includes mercury thermometer.
- 8169 THERMOHM, for Air-Duct Mounting**  
Nickel wire resistor in nickel-plated brass case. Furnished with bracket and five feet of leads.
- 8136 THERMOHM, for Water-Line Mounting**  
Nickel wire resistor in tin-plated copper case. Fits No. 10020 and No. 10021 Protecting Wells.
- 10020 PROTECTING WELL, STEEL, for No. 8136 Thermohm**  
Total length  $5\frac{1}{4}"$ ; insertion  $4\frac{3}{16}"$ ; pipe thread  $\frac{3}{4}"$ . Furnished in other lengths on special order.
- 10021 PROTECTING WELL, MONEL METAL, for No. 8136 Thermohm**  
Same as No. 10020, except in material.
- 8173-A1 WET-AND-DRY-BULB THERMOHM ASSEMBLY, primarily for Duct Mounting**  
Can be arranged for wall mounting. Comprises two Thermohms, nickel-wire resistors in nickel-plated brass cases; cast mounting with trough for wet bulb; and special feed valve. Trough fed from regular water supply—special feed valve connects in series with standard needle valve (not furnished) in water supply line.
- 8173-A2 WET-AND-DRY-BULB THERMOHM ASSEMBLY**  
Same as No. 8173-A1, except comprises bottle feeder in place of feed valve. Trough fed from water bottle.

## LEADWIRE

- No. 16-P3 THREE-CONDUCTOR CABLE, RUBBER COVERED**  
Comprises three No. 16 B & S gauge copper wires, rubber insulation.
- No. 16-Q3 THREE-CONDUCTOR CABLE, LEAD COVERED**  
Same as No. 16-P3, but incased in lead sheathing.



Model S Micromax Recorder  
(About 1/7 Size)



Model R Micromax Recorder  
(About 1/7 Size)

### MODEL S MICROMAX RECORDERS

Multiple-Point, Strip-Chart, Curve Printing

21366	SIXTEEN-POINT RECORDER	21358	EIGHT-POINT RECORDER
21364	FOURTEEN-POINT RECORDER	21356	SIX-POINT RECORDER
21362	TWELVE-POINT RECORDER	21354	FOUR-POINT RECORDER
21360	TEN-POINT RECORDER	21353	THREE-POINT RECORDER

Recorder Circuit....Null-balance (Wheatstone) bridge  
 Marking Device....Print Wheel  
 \*Record.....Numbered dot for each Thermohm  
 Range.....0-100° F., or other ranges, if required  
 Primary Element....Nickel Thermohm  
 Chart Speed.....3 inches (nominal) per hour  
 Motor.....Synchronous for 110 volts, a. c.; governed for 110 or 220 volts, d. c.  
 Time Cycle.....One minute (nominal) per Thermohm recorded  
 Case.....V-4, Metal, Dust-Proof, for Flush or Front of Panel Mounting,  
 Connections Through Back or Bottom

Two-Point, Strip-Chart, Curve Drawing

21112	TWO-POINT RECORDER	21102	TWO-POINT RECORDER
Same as Model S Multiple-Point Recorders except pen replaces print wheel and draws curve in red ink; and time cycle is forty-five seconds (nominal) for each Thermohm. No. 21102 draws continuous line record; No. 21112, dot for one Thermohm, dash for the other.			

### MODEL R MICROMAX RECORDER

Two-Point, Round-Chart, Curve Drawing

31102	TWO-POINT RECORDER
Recorder Circuit....Null-balance (Wheatstone) bridge	
Marking Device....Pen	
Record.....Continuous line	
Range.....0-100° F., or other ranges, if required	
Primary Element....Nickel Thermohm	
Chart Speed.....One revolution in twenty-four hours	
Motor.....Synchronous for 110 volts, a. c.	
Time Cycle.....Two minutes (nominal) for each Thermohm; 48 seconds if so specified.	
Case.....Round, Metal, Dust-Proof, for Flush Mounting; Connections Through Bottom (Can be adapted for front of panel mounting)	

Current for the bridge circuit, in all Micromax recorders having a. c. motors, is obtained from the a. c. source through a rectifier in the recorder. This eliminates the need for dry cells, except in recorders with d. c. motors.

\*A Model S Recorder for 3, 4 or 6 points can be furnished for multi-color printing, where the record for each Thermohm is in a different color. Multi-colored records may be numbered dots, or simply dots.



## LEEDS &amp; NORTHRUP COMPANY



No. 8053 Switchboard  
Model Indicator  
(About 1/6 Size)



No. 8240-3  
Ten-Point Rotary Switch  
(About 1/6 Size)



No. 8054 Wall Model  
Indicator  
(About 1/6 Size)



Indicator Mounted in  
No. 8432-103 Cabinet with one  
10-Point Rotary Switch  
(About 1/10 Size)

## INDICATORS

## 8053 SWITCHBOARD MODEL INDICATOR

Range as specified; case metal, black lacquer finish; studs on back for switchboard mounting; connections through back.

## 8054 WALL MODEL INDICATOR

Same as No. 8053, but with lugs for wall mounting and terminal board at bottom of case.

## ROTARY SELECTOR SWITCHES

## 8240-3 TEN-POINT ROTARY SWITCH

Three-pole; for flush mounting; click stop.

## 8241-3 TEN-POINT ROTARY SWITCH

Same as No. 8240-3, but vapor-proof.

## INDICATOR CABINETS WITH SWITCHES

8432-103 INDICATOR CABINET, with one 10-point Rotary Switch. (Indicator is extra)

8432-203 INDICATOR CABINET, with two 10-point Rotary Switches. (Indicator is extra)

8432-303 INDICATOR CABINET, with three 10-point Rotary Switches. (Indicator is extra)

8432-403 INDICATOR CABINET, with four 10-point Rotary Switches. (Indicator is extra)

## SUPPLIES

Std. 1006-1 Wet-Bulb Wicks, for Nos. 8173-A1 and 8173-A2 Wet-and-Dry-Bulb Thermohm Assemblies, lot of 6 wicks.

R-23 Pen, for No. 21112 Model S Recorder.

R-156 Pen, for No. 21102 Model S Recorder.

R-403-J Pen, for No. 31102 Model R Recorder.

R-60-L Blue Ink, 1 oz., for Model S, Multiple-Point Recorder.

R-60-E Inking Pads, 1/2 dozen, for Model S, Multiple-Point Recorder.

R-23-O Red Ink, 1 oz., for Models S and R, Two-Point (continuous line) Recorder.

R-23-N Red Ink, 8 oz., for Models S and R, Two-Point (continuous line) Recorder.

R-23-W Red Ink, 1 qt., for Models S and R, Two-Point (continuous line) Recorder.

R-23-S Red Ink, 1 oz., for Model S, Two-Point (dot and dash) Recorder.

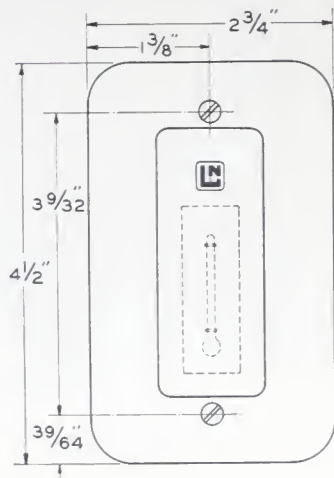
R-23-R Red Ink, 8 oz., for Model S, Two-Point (dot and dash) Recorder.

R-23-Y Red Ink, 1 qt., for Model S, Two-Point (dot and dash) Recorder.

Strip Charts for Model S Recorder, in Rolls, approximately 40 yards each.

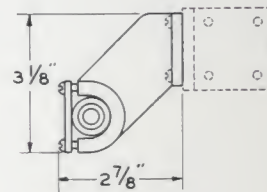
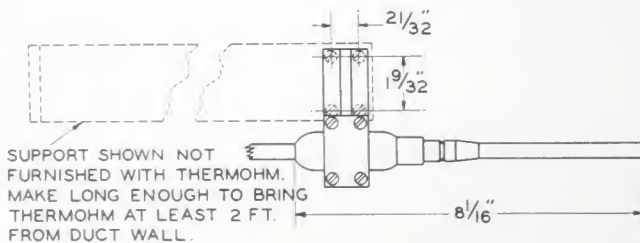
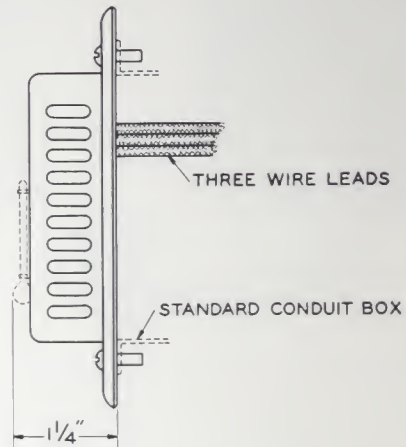
Round Charts for Model R Recorder, in Boxes of 100 charts each.

## MOUNTING DIMENSIONS

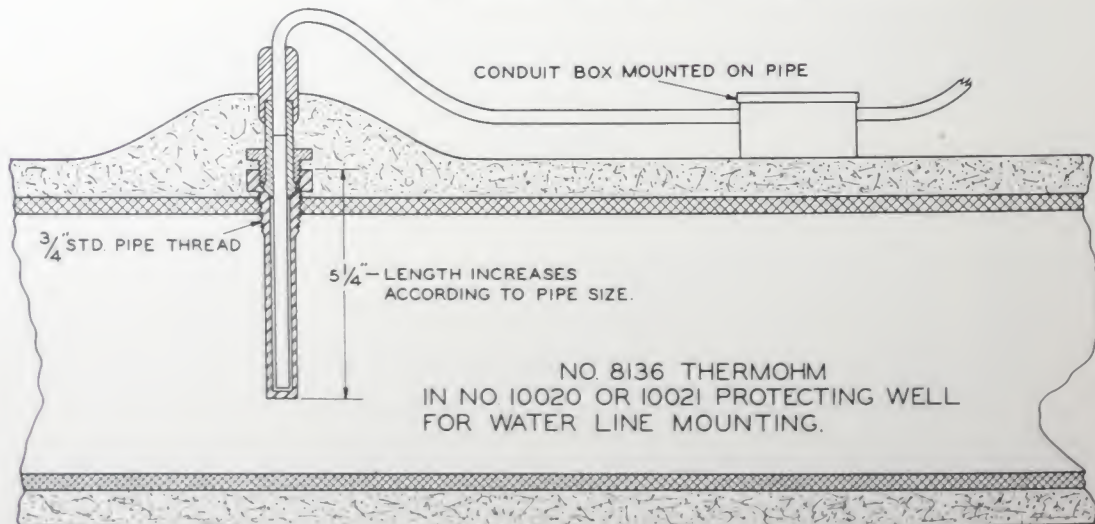


NOS. 8165 & 8166  
THERMOHMS FOR  
WALL MOUNTING

MERCURY THERMOMETER  
SHOWN DOTTED ON FRONT  
OF CASE SUPPLIED WITH  
NO. 8166 ONLY.



## NO. 8169 THERMOHM FOR AIR DUCT MOUNTING

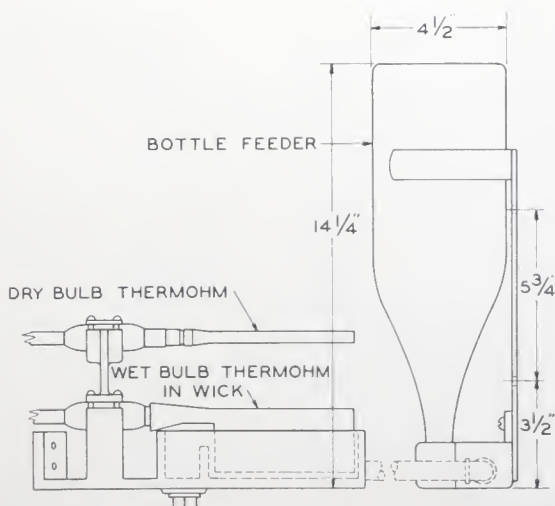
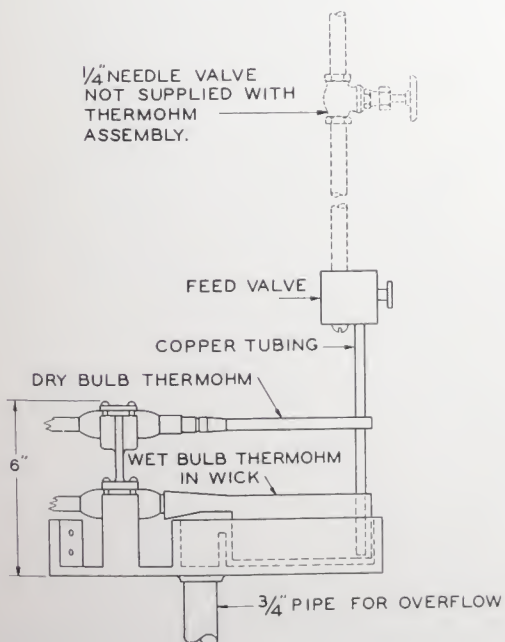
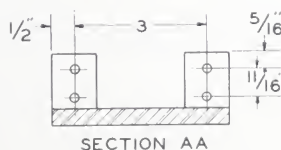
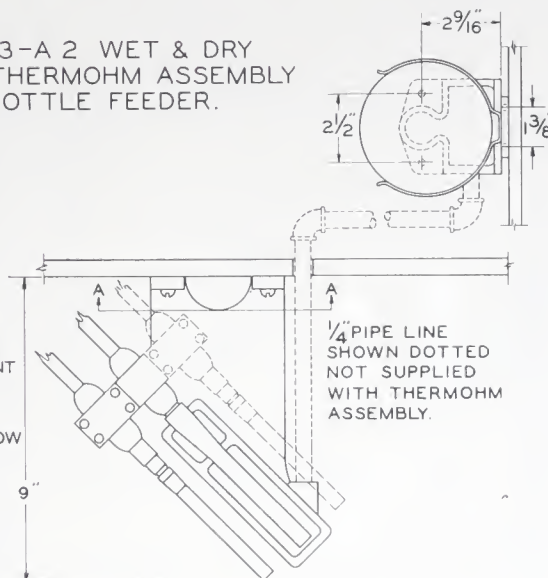
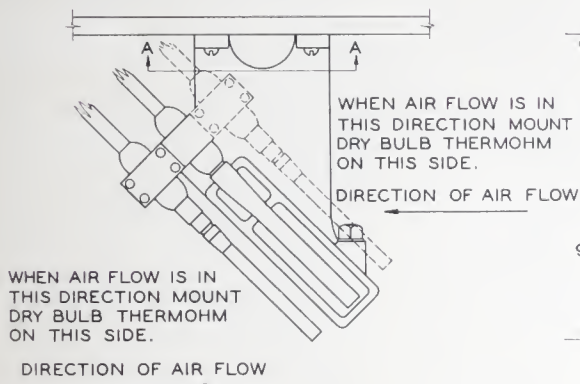




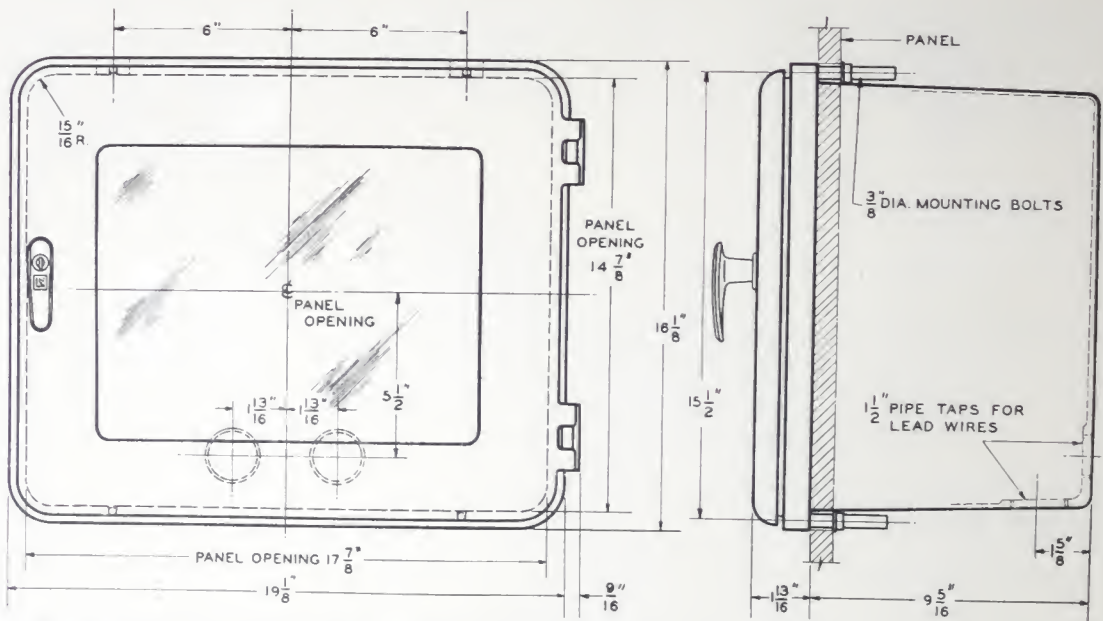
## MOUNTING DIMENSIONS

NO. 8173-A 1 WET & DRY  
BULB THERMOHM ASSEMBLY  
WITH FEED VALVE FOR  
CONNECTION TO REGULAR  
WATER SUPPLY.

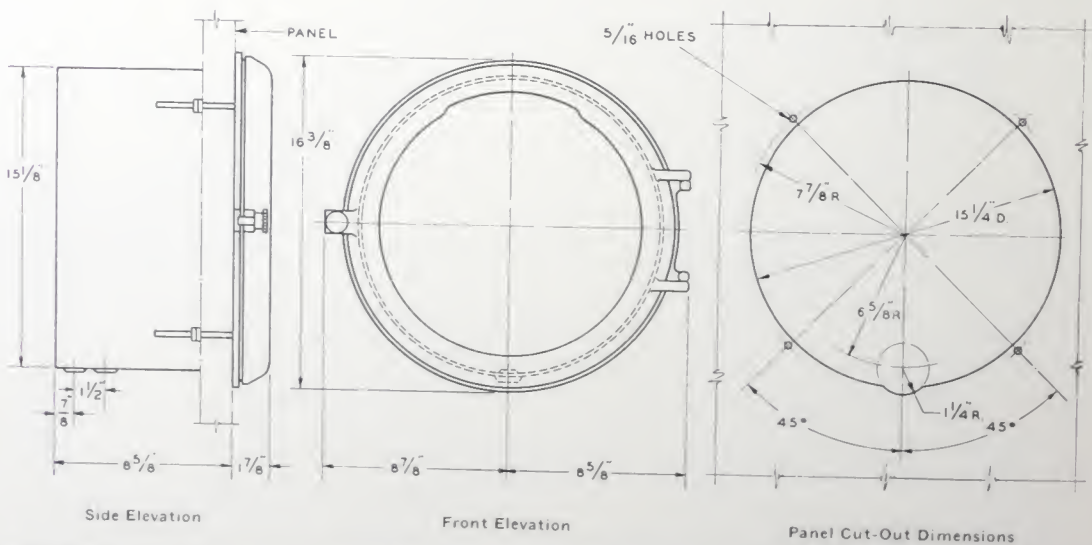
NO. 8173-A 2 WET & DRY  
BULB THERMOHM ASSEMBLY  
WITH BOTTLE FEEDER.



## MOUNTING DIMENSIONS



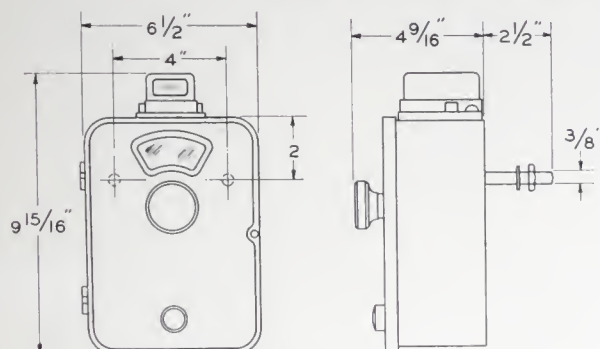
Model S Micromax Recorder. This case is designed for flush mounting, as shown in the diagram, but can be equipped with lugs on the back for front of panel mounting



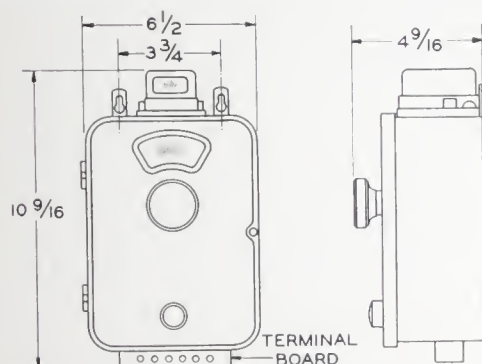
Model R Micromax Indicating Recorder. This case is designed for flush mounting, as shown in the diagram, but can be equipped with lugs on the back for front of panel mounting



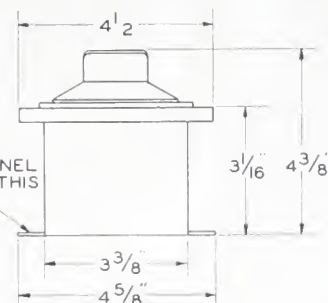
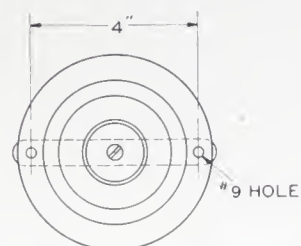
## MOUNTING DIMENSIONS



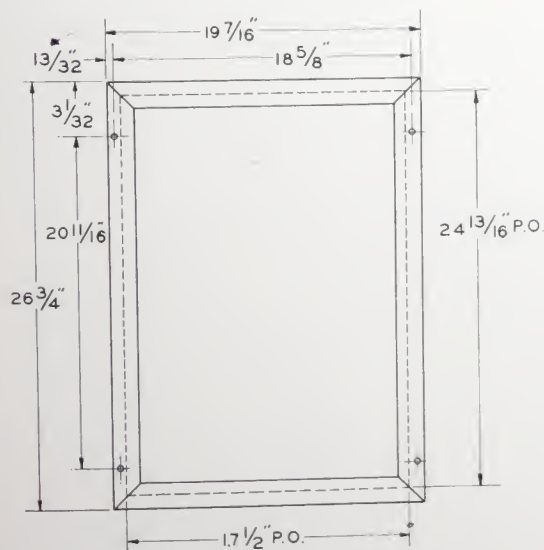
NO. 8053 SWITCHBOARD MODEL INDICATOR



NO. 8054 WALL MODEL INDICATOR



FOR FLUSH PANEL  
MTG. REMOVE THIS  
STRAP

NO. 8240-3 OR 8241-3  
TEN-POINT ROTARY SWITCHNO. 8432 INDICATOR  
CABINET

FLUSH MOUNTING SHOWN  
CAN ALSO BE SUPPLIED  
FOR FRONT OF PANEL  
MOUNTING.

P.O. = PANEL OPENING

## OTHER APPLICATIONS WHERE L & N INSTRUMENTS AND CONTROLS EFFECT SAVINGS

### ELECTRIC POWER GENERATION

Generator Stator Temperature  
Generator Rotor Temperature  
Generator Cooling Air or Gas Temperature  
Generator Air-Cooler Water Temperature  
Generator Bearing or Oil Temperature  
Frequency  
Generator and Station Load  
Remote Metering  
Frequency and Load Control

### STEAM & STEAM POWER GENERATION

Combustion Control  
Furnace Pressure Control  
Furnace Temperature  
Boiler Pass Gas Temperature  
Flue Gas Temperature  
Flue Gas Analysis  
Smoke Density  
Preheater Air Temperature  
Economizer Water Temperature  
Feed Water Temperature  
Boiler Steam Temperature  
Superheater Steam Temperature  
Condenser Steam Temperature  
Cooling Water Temperature  
Condensate Temperature  
Condensate Purity  
Make-Up pH (Acidity and Alkalinity)  
Make-Up Conductivity  
Boiler Water Concentration  
Turbine Steam and Water Temperature  
Turbine Bearing or Oil Temperature  
Turbine Speed

### STEAM DISTRIBUTION

Steam Temperature  
Remote Pressure  
Flow

### DIESEL POWER GENERATION

Engine Bearing or Oil Temperatures  
Engine Cooling Water Temperatures  
Engine Speed  
Engine Exhaust Temperatures

### REFRIGERATION

Refrigerating Unit Temperatures  
Refrigerated Atmosphere Temperatures

### FLUID STORAGE AND DISTRIBUTION

Liquid Level  
Gate Position  
Remote Pressure  
Flow

### LABORATORIES AND MAINTENANCE

Heat Value of Fuel  
Instrument and Meter Calibration  
Instrument-Transformer Testing  
Pyrometer Testing  
Water Purity Testing  
Insulation Resistance  
Dielectric Loss  
Conductor Resistance  
Conductor Faults

In addition to the above Applications, L & N Measuring Instruments and Control Equipments apply in many other Service and Testing Applications and to a wide variety of Production Processes.